PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

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PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing (*day/month/year*) 30 JUN 2005

Applicant's or agent's file reference
SHI 21053PCT

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date (*day/month/year*)	Priority date (*day/month/year*)
PCT/US05/07981	08 March 2005 (08.03.2005)	08 March 2004 (08.03.2004)

International Patent Classification (IPC) or both national classification and IPC
IPC(7): F25B 9/00 and US Cl.: 62/6

Applicant
SHI-APD CRYOGENICS, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I — Basis of the opinion
- ☐ Box No. II — Priority
- ☐ Box No. III — Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV — Lack of unity of invention
- ☒ Box No. V — Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI — Certain documents cited
- ☐ Box No. VII — Certain defects in the international application
- ☐ Box No. VIII — Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(*b*) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US05/07981

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,694,749 B2 (HERON) 24 February 2004 (24.02.2004), see entire document.	1-8
Y	US 2002/0066,276 A (KAWANO) 06 June 2002 (06.06.2002), see entire document.	1-8
A	US 4,373,476 A (VERVOORDT et al) 15 February 1983 (15.02.1983), see entire document.	1-12

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US05/07981

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This opinion has been established on the basis of a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☐ a sequence listing

☐ table(s) related to the sequence listing

b. format of material

☐ in written format

☐ in computer readable form

c. time of filing/furnishing

☐ contained in international application as filed.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US05/07981

Box No. V Reasoned statement under Rule 43 *bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-8	YES
	Claims 9-12	NO
Inventive step (IS)	Claims NONE	YES
	Claims 1-12	NO
Industrial applicability (IA)	Claims 1-12	YES
	Claims NONE	NO

2. Citations and explanations:

Please See Continuation Sheet

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US05/07981

Supplemental Box
In case the space in any of the preceding boxes is not sufficient.

V. 2. Citations and Explanations:
Claims 9-12 lack novelty under PCT Article 33(2) as being anticipated by Schultz (US 3,677,295).
Schultz discusses in lines 70-75 of column 2, a rotary valve with a thrust bearing between a rotary disk and a valve seat which contact each other. Contact between parts is seen as being separated by less than 25 micrometers.

Claims 9-12 lack novelty under PCT Article 33(2) as being anticipated by Warf (US 5,315,963).
Warf discusses between line 44 of column 3 and line 2 of column 4, a rotary valve with a thrust bearing between a rotary disk and a valve seat which contact each other. Contact between parts is seen as being separated by less than 25 micrometers.

Claims 9-12 lack novelty under PCT Article 33(2) as being anticipated by Holl (US 2,832,561).
Holl discusses in lines 6-28 of column 2, a rotary valve with a thrust bearing between a rotary disk and a valve seat which contact each other. Contact between parts is seen as being separated by less than 25 micrometers.

Claims 9-12 lack novelty under PCT Article 33(2) as being anticipated by Hall (US 2,319,733).
Hall shows in figure 1, a rotary valve with a thrust bearing between a rotary disk and a valve seat which contact each other. Contact between parts is seen as being separated by less than 25 micrometers.

Claims 1,2 and 4 lack an inventive step under PCT Article 33(3) as being obvious over Schultz in view of either Heron or Kawano. Schulz discloses applicants' basic inventive concept, a rotary valve having a thrust bearing attached to the valve seat to reduce wear between the disk and the seat, substantially as claimed with the exception of using the rotary valve in a pulse tube cooler. Heron and Kawano each show rotary valves to be old in the pulse tube cooling art. It would have been obvious to one of ordinary skill in the art at the time of applicants' invention from the teaching of either Heron or Kawano to use a rotary valve with a thrust bearing in a pulse tube cooler to reduce wear between the parts to make the valve easier to turn and increase projected lifetime of the parts.

Claims 1,3 and 5-8 lack an inventive step under PCT Article 33(3) as being obvious over Holl in view of either Heron or Kawano. Holl discloses applicants' basic inventive concept, a rotary valve having a thrust bearing attached to the valve disk to reduce wear between the disk and the seat, substantially as claimed with the exception of using the rotary valve in a pulse tube cooler. Heron and Kawano each show rotary valves to be old in the pulse tube cooling art. It would have been obvious to one of ordinary skill in the art at the time of applicants' invention from the teaching of either Heron or Kawano to use a rotary valve with a thrust bearing in a pulse tube cooler to reduce wear between the parts to make the valve easier to turn and increase projected lifetime of the parts. In regard to claim 8, Fixtures are well known to attach bearings to a part and as such would have been obvious to an ordinary practitioner in the art to ensure a proper mounting of the bearing.

Claims 1,3 and 5-8 lack an inventive step under PCT Article 33(3) as being obvious over Hall in view of either Heron or Kawano. Hall discloses applicants' basic inventive concept, a rotary valve having a thrust bearing attached to the valve disk to reduce wear between the disk and the seat, substantially as claimed with the exception of using the rotary valve in a pulse tube cooler. Heron and Kawano each

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US05/07981

Supplemental Box
In case the space in any of the preceding boxes is not sufficient.

show rotary valves to be old in the pulse tube cooling art. It would have been obvious to one of ordinary skill in the art at the time of applicants' invention from the teaching of either Heron or Kawano to use a rotary valve with a thrust bearing in a pulse tube cooler to reduce wear between the parts to make the valve easier to turn and increase projected lifetime of the parts. In regard to claim 8, Fixtures are well known to attach bearings to a part and as such would have been obvious to an ordinary practitioner in the art to ensure a proper mounting of the bearing.

Claims 5 and 6 lack an inventive step under PCT Article 33(3) as being obvious over Rabenau in view of either Heron or Kawano. Rabenau discloses applicants' basic inventive concept, a rotary valve having a thrust bearing attached to the valve seat to reduce wear between the disk and the seat which contact each other, substantially as claimed with the exception of using the rotary valve in a pulse tube cooler. Heron and Kawano each show rotary valves to be old in the pulse tube cooling art. It would have been obvious to one of ordinary skill in the art at the time of applicants' invention from the teaching of either Heron or Kawano to use a rotary valve with a thrust bearing in a pulse tube cooler to reduce wear between the parts to make the valve easier to turn and increase projected lifetime of the parts.

Claims 1-8 lack an inventive step under PCT Article 33(3) as being obvious over Warf in view of either Heron or Kawano. Warf discloses applicants' basic inventive concept, a rotary valve having a thrust bearing attached to the valve disk and to the valve seat to reduce wear between the disk and the seat, substantially as claimed with the exception of using the rotary valve in a pulse tube cooler. Heron and Kawano each show rotary valves to be old in the pulse tube cooling art. It would have been obvious to one of ordinary skill in the art at the time of applicants' invention from the teaching of either Heron or Kawano to use a rotary valve with a thrust bearing in a pulse tube cooler to reduce wear between the parts to make the valve easier to turn and increase projected lifetime of the parts. In regard to claim 8, Fixtures are well known to attach bearings to a part and as such would have been obvious to an ordinary practitioner in the art to ensure a proper mounting of the bearing.

Claims 1-12 meet the criteria set out in PCT Article 33(4), and thus possess industrial applicability because the subject matter claimed can be made or used in industry.